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Aggie J. Noah, Ph.D. Candidate
Department of Sociology
Population Research Institute
The Penn State University
ajn164@psu.edu

Wei-lin Lin, Ph.D. Candidate
Department of Rural Sociology
Population Research Institute
The Penn State University
wuw134@psu.edu

Tse-Chuan Yang, Ph.D.
Department of Sociology
University at Albany
State University of New York
tyang3@albany.edu

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Abstract

Sexually transmitted diseases during pregnancy (STDDP) can have serious lasting and cumulative implications for both women and their children; thus, reducing the gap in black-white racial disparity in the acquisition of STDDP is an important public health concern in the United States. Using 2012 population data from Pennsylvania and the 2009–2013 American Community Survey, we investigate the roles of residential racial segregation and income inequality for the black-white disparity in the acquisition of STDDP in a multilevel framework. The results indicate that incorporating neighborhood-level factors is important for understanding this disparity: racial segregation and income inequality are significantly associated with the odds of STDDP. Racial segregation moderates the relationships between race/ethnicity and the acquisition of STDDP: black mothers are less likely to acquire STDDP if they reside in neighborhoods that are more segregated from non-Hispanic whites. Mothers residing in the most socioeconomically disadvantaged neighborhoods—as indicated by both absolute and relative measures of income inequality—have the highest odds of acquiring STDDP. Our findings have important implications for future research and for place-specific prevention and intervention to reduce the racial disparity in STDDP.

Keywords

Sexually transmitted diseases, pregnancy, racial segregation, income inequality

Introduction

Eliminating racial health disparities has been identified as one of the main goals of the U.S. public health policy (U.S. Department of Health and Human Services, 2011), and achieving this goal for maternal health is particularly important because it can have serious lasting and cumulative implications for both women and their children. One important aspect of racial health disparities in maternal health (Biello et al., 2012; Hogben & Leichliter, 2008) is the acquisition of sexually transmitted diseases during pregnancy (hereafter STDDP). Health disparities between non-Hispanic blacks and non-Hispanic whites (hereafter, blacks and whites) are well-documented for sexually transmitted diseases: blacks are at substantially elevated risk of STD acquisition. For example, in 2013, the rates of reported cases of chlamydia and gonorrhea for blacks were, respectively, 6.4 and 12.4 times the rates of whites (Centers for Disease Control and Prevention, 2014). This disproportionate burden is even heightened for some age groups; for example, in 2013, rates of gonorrhea for blacks were 17.7 times than whites among 15- to 19-year-olds (Centers for Disease Control and Prevention, 2014). In spite of the well-known black-white disparity in STD rates, even simple documentation of racial disparities in STDDP has received little systematic attention, and studies of STDDP are scant, with research being only descriptive (Johnson et al., 2007).

Understanding the factors affecting the acquisition of STDDP is particularly important for three reasons. First, rates of STDDP are alarming. For instance, in 2006, about 13.3% of new cases of STD among women aged 15–49 occurred to pregnant women (Johnson et al., 2007). Second, in addition to the negative consequences associated with the acquisition of STD for women's reproductive health in general, the acquisition of STDDP has heightened risks for both mothers and their infants (Jackson & Soper, 1997). For example, the acquisition of STDDP is associated with higher rates of several serious pregnancy complications, such as ectopic pregnancy, spontaneous abortion, premature rupture of membranes, preterm birth, low birth weight, congenital anomalies, neurological abnormalities, blindness, pneumonia, and perinatal mortality (Johnson et al., 2007). Pregnancy complications resulting from STDDP are prevalent: nearly 40% of all excess preterm births and infant deaths are estimated to be attributable to STDDP (Johnson et al., 2007). Third, pregnant women can acquire an STD throughout her pregnancy. Although the risk of the acquisition of STD decreases with increasing gestation as the frequency of sexual intercourse decreases, a nontrivial number of pregnant women (i.e., 28 to 40 percent) are at continued of the acquisition of STD even during the later stages of their pregnancy (Johnson et al., 2007). Together, these reasons demonstrate the need for more systematic research to promote screening and prevention of STDs for women throughout pregnancy.

The goal of this study is to fill this knowledge gap by investigating both the individual and contextual determinants of STDDP with a population dataset in Pennsylvania. We begin by reviewing prior research on STD acquisition, which has focused solely on individual-level risk factors or contextual factors; we elaborate on the importance of incorporating contextual-level factors in a multilevel framework. We review prior research on STD acquisition—rather than literature on STDDP—because there are no multivariate studies on STDDP to date. Then, we consider residential racial segregation and income inequality to investigate the roles of neighborhood-level inequalities on STDDP. After describing our methods and data, we report the findings and discuss the implications of our results for policy and future research.

Current study

In summary, this study examines the understudied topic of the racial disparity in STDDP acquisition. Drawing from the aforementioned studies, we hypothesize that residential segregation is positively associated with the acquisition of STDDP but that income inequality is not significantly associated with the acquisition of STDDP. To the best of our knowledge, this study is the first to investigate how neighborhood characteristics are associated with the acquisition of STDDP using a multilevel approach. The current study contributes to the literature in three ways. First, we focus on STD acquisition during pregnancy as our main outcome, which has not been examined using the multivariate approach. Second, we employ a multilevel approach by using population data from Pennsylvania (the advantages of our data will be discussed later). Third, we use the residential segregation measures rather than simplistic racial/ethnic composition measures.

Data and methods

Data

Data for this study come from two sources. The individual-level data for the study are from the Commonwealth of Pennsylvania Department of Health Bureau of Health Statistics and Research—Master File Birth Extract. This dataset is based on the total population of women who had a live birth in Pennsylvania during 2012 calendar year, and it includes detailed information on women's prenatal health, birth experience, and birth outcomes. The contextual-level data are from five-year estimates of the 2009–2013 American Community Survey. We use the census tract as a proxy for individuals' neighborhoods, which is a common practice in health research (Wight et al., 2013). A total of 139,463 births occurred in Pennsylvania during the 2012 calendar year. We exclude 21,863 of these births (i.e., 15.7%) because they did not have any geographic identifiers. Of the 117,600 births with appropriate geographic identifiers, we exclude those missing information on race (N = 4,282) and Hispanic ethnicity (N = 926), which constitutes about 4.4% of the total population. Our analytic sample includes mothers who self-identified as non-Hispanic white (N = 79,271) or non-Hispanic black (N = 17,669). Our final sample is 96,940 respondents residing in 3,154 neighborhoods (tracts). We obtained approval to conduct the research from the human subjects review board at the Pennsylvania State University.

Measures

Neighborhood-level: Residential segregation and income inequality

Although racial segregation can be measured with five dimensions—namely, evenness, exposure, concentration, centralization, and clustering (Massey & Denton, 1988)—we focus on exposure and concentration because they are identified as the most relevant dimensions for infectious diseases (Acevedo-Garcia, 2000). Exposure measures the degree of potential contact between groups within neighborhoods (Massey & Denton, 1988), and we assess this dimension with *the isolation index* (${}_xP^*{}_x$), , which is calculated as follows:

$$P = \sum_{i=1}^{N} \frac{x_i}{X} * \frac{x_i}{t_i},$$

where x_i indicates the population of group x (e.g., blacks) in a blockgroup i, and X indicates the total population group x in the neighborhood (tract), and t_i refers to the total population in a blockgroup i. The isolation index ranges from 0 (no isolation) to 1 (complete isolation). In other words, the isolation index measures "the extent to which minority group members are exposed only to one another" (Massey & Denton, 1988).

The dimension of concentration measures the relative amount of physical space a minority group occupies in the neighborhood (tract). To measure concentration, we utilize the *delta index* (DEL), which indicates the proportion of a minority group that would have to move in order to produce a uniform density across neighborhoods. This index is calculated as follows:

$$DEL = \frac{1}{2} \sum_{i=1}^{N} \left| \frac{x_i}{X} - \frac{a_i}{A} \right|,$$

where x_i and X have the same definitions as in the isolation index; a_i indicates the land area of blockgroup i, and A is total land are in the neighborhood tract. The delta measures "the proportion of [minority] members residing in areal unit with above average density of [minority] members" (Massey & Denton, 1988).

In addition to the direct associations between residential segregation and STDDP, we include the cross-level interaction terms (individual race × residential segregation indices) to test the potential moderating associations between residential segregation and STDDP.

With respect to income inequality, we use two measures: (1) a *Gini index*, which measures structural inequality (relative measure of income distribution), and (2) a *poverty index*, which measures the absolute deprivation (absolute measure of income distribution). The Gini index is arguably the most common measure of income inequality; it ranges from 0, indicating no income equality (i.e., everyone has the same income), to 1, representing complete income inequality (i.e., one person has all the income while everyone else has zero income). Following previous research for creating neighborhood-level composite measures (Sampson et al., 1997), we first use principal components analysis to confirm the emergence of one factor for two variables: percentage of the household living below the poverty line (factor loading = 0.93) and percentage unemployed (0.93). Then, we use the regression-weighted method to create the poverty index. Finally, we follow previous research (Harling et al., 2014) in transforming the

Gini index and poverty index into quintiles, because quintiles imply that the effects of Gini or poverty indices on STDDP may be nonlinear, and we are not imposing any assumption on these relationships.

Individual-level variables

The dependent variable used in this analysis, *the acquisition of STDDP*, is measured as a dichotomous variable; women who acquired any of several; STDs (i.e., gonorrhea, chlamydia, syphilis, herpes simplex virus, or hepatitis B or C) during pregnancy are coded as 1.

Drawing from the literature, we include several individual-level sociodemographic factors. *Maternal race* is a dichotomous variable indicating whether a woman reported their race as non-Hispanic black (coded 1 if black, and 0 if white). Maternal age at the time of infant's birth is measures as the continuous variables *age* and *age squared*. If women were married at the time of infant's birth, their *marital status* is coded as 1 and 0 if they were not married or in other marital statuses. A set of four dummy variables are created to measure *maternal education*: less than high school (reference), high school diploma or equivalent degree, some college, and bachelor's degree or higher. We use whether mothers received the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) as a proxy of *maternal poverty status*. We also include two pregnancy-related individual-level factors: (1) the *total number of prenatal visit*, a count variable indicating how many times women received prenatal care during their pregnancies; and (2) a set of four dummy variables measuring women's *insurance status* to indicate the method of payment for their delivery—namely, private insurance (reference), Medicated, self-pay, and other.

Analytic strategy

In our data, less than 4% of women have missing values on at least one variable included in the models. We impute 25 datasets to take the uncertainty of imputed values into account (Rubin, 1987). Descriptive and multilevel results are from the imputed datasets. To examine the roles of residential segregation and income inequality on STDDP, we use multilevel logistic models using the *mi estimate xtmelogit* command in Stata. Before specifying our models, we first test the null model in which no independent variable is considered to test the appropriateness of multilevel modeling. After establishing justification for multilevel modeling, we include individual-level and contextual-level factors. Specifically, we model STDDP as follows:

$$\eta_{ij} = \log\left(\phi_{ij}/1 - \phi_{ij}\right) = \gamma_{00} + u_{0j} + \sum \gamma_{0l} W_{lj} + \sum \beta_{kj} Z_{ijk},$$

where, η_{ij} is the log odds of STDDP for the *i*th individual living in the *j*th neighborhood (i.e., tract), ϕ_{ij} refers to the odds of acquiring STDDP, γ_{00} indicates the intercept, u_{0j} represents the random effect specific to each neighborhood, γ_{0l} estimates the association of neighborhood level factor W_{lj} (covariate *l* in the *j*th neighborhood) with STDDP, and β_{kj} captures the individual level effect of Z_{ijk} (feature *k* or the *i*th respondent in the *j*th neighborhood) on contracting STDDP. For the cross-level interaction, we include the following term in the preceding model:

$$\beta_{maternal\,race,j} = \gamma_{10} + \gamma_{maternal\,race,segregation} * W_{segregation,j} + u_{1j},$$

where $\gamma_{maternal\,race,segregation}$ is the estimated moderation association between maternal race and neighborhood segregation level, and u_{1j} indicates the random effect specific to maternal race that varies across neighborhoods.

Results

Descriptive statistics

Table 1 shows descriptive statistics for all variables included in the models for all women as well as for each racial/ethnic group. Overall, about 5.5% of women who had had a live birth in Pennsylvania during 2012 acquired STD during their pregnancies. This is similar to previous research, which estimated that about 1% to 5% of all pregnant women in the United States had chlamydia or gonorrhea (Goldenberg et al., 2005). However, this percentage varies by race, with the number of mothers who acquired STDDP about three times higher for blacks (12.1%) than for whites (4.1%). Other individual characteristics also vary by race. Whereas 67.6% of white mothers were married at the time of the birth, only 20.6% of black mothers were married. Large differences appear in the educational attainment of white and black mothers. For example, 41.4% of white mothers but only 12.0% of black mothers have bachelor's degree or higher. In addition, black mothers are more like to have poverty status, with 68.3% of black mothers but only 28.3% of white mothers receiving WIC benefits. While the majority of white mothers used private insurance (71.3%) to pay for their deliveries, the majority of black mothers used Medicaid (61.5%), which has a low income threshold requirement for eligibility, providing auxiliary evidence that black mothers are socioeconomically disadvantaged.

[Table 1]

The characteristics of the mothers' neighborhoods vary considerably. On average, black mothers reside in highly segregated neighborhoods with an isolation index of 0.63, which indicates that black mothers have higher propensity to be exposed only to other blacks in their neighborhoods. In comparison, white mothers reside in less-segregated neighborhoods. Physical spaces occupied by black and white mothers were about equivalent as measured by the concentration index. With respect to income inequality, white mothers were more equally distributed across the five quintiles than were their black counterparts; furthermore, almost 70%

of black mothers lived in the two least-equal neighborhoods, in contrast to 35% of white mothers in the same quintiles. A similar pattern could be observed for poverty, with approximately 30% of white mothers but 75% black mothers living in the two poorest neighborhoods. These racial differences at the neighborhood level suggest that neighborhoods should play a role in the acquisition of STDDP.

Multilevel logistic regression results

The results in Table 2 show the associations between neighborhood characteristics and the acquisition of STDDP. Prior to the model specifications, we test the intercept-only null models (i.e., variance component intercepts) to confirm the appropriateness of using the multilevel models. The results support the use of multilevel models and indicate that a large proportion of the variance in STDDP is explained by differences between neighborhood contexts (14.4%). Next, we include the residential segregation measures and cross-level interaction measures (Model 1) and then examine income inequality and poverty index quintiles in Model 2 and Model 3, respectively. In our final model (Model 4), all neighborhood characteristics are included to jointly investigate how segregation and income inequality contribute to STDDP.

[Table 2]

Individual-level results are consistent across models; thus, we report the results from the final model (Model 4). Assuming that there is no segregation, the odds of STDDP acquisition is 60% higher for non-Hispanic black women compared with non-Hispanic white women (OR: 1.60; 95% CI: 1.41–1.80). Maternal age is significantly associated with the odds of STDDP acquisition: a one-year increase in maternal age is associated with roughly an 8% decrease in the odds of STDDP acquisition ($0.92^{(1)} \times 1.00^{(1) \times (1)} = 0.92$). In addition, the odds of STDDP acquisition are lower for married mothers than for unmarried mothers, and lower for mothers with relatively high educational attainment levels. Specifically, the odds of STDDP acquisition are reduced by nearly one-half for women who were married at the time of the infant's birth (odds ratio = 0.49; 95% CI = 0.45–0.53), and this association is stable across models. Furthermore, compared with mothers who have less than a high school education, the odds of STDDP acquisition is 18% (OR: 0.83; 95% CI: 0.75–0.90) and 38% (OR: 0.62; 95% CI: 0.55–0.70) lower for mothers with some college and for mothers with bachelor's degree or higher, respectively. Lastly, indicators for mothers' socioeconomic status are significantly associated with the odds of STDDP acquisition. Mothers who receive WIC benefits are about 12% (OR: 1.12; 95% IC: 1.04–1.20) more likely to have acquired STDDP compared with mothers not receiving WIC benefits. Similarly, mothers who used Medicaid to pay for their delivery have 44% (OR: 1.44; 95% CI: 1.34–1.55) higher odds of STDDP acquisition than those who paid using private insurance.

The multivariate models show that neighborhood context explains a substantial proportion of individual-level variance in STDDP acquisition. Specifically, neighborhood residential segregation has both direct and indirect associations with women's odds of STDDP acquisition. Racial segregation is significantly associated with the odds of STDDP acquisition when isolation index was used. The first model shows that the odds of STDDP acquisition increase by 2.5 times (OR: 2.47; 95% CI: 1.99–3.08) when mothers reside in more racially isolated neighborhoods (Model 1). However, the dimension of concentration is not significantly associated with STDDP. More importantly, the cross-level interaction between maternal race and isolation suggests that among black mothers, those who live in a more segregated neighborhood are less likely to have acquired STDDP (OR: 0.56; 95% CI: 0.43–0.73) (Model 2).

Neighborhood-level income inequality is also significantly associated with the odds of STDDP acquisition. For structural inequality, which measures relative income inequality, the odds of STDDP acquisition are 13% (OR: 1.13; 95% CI: 1.01–1.25) and 26% (OR: 1.26; 95% CI: 1.13–1.40) higher for women in the middle quintile and the least-equal quintile, respectively (Model 2). Similarly, the results for absolute deprivation, measured by the poverty index, show that the odds of STDDP acquisition are 18% (OR: 1.18; 95% CI: 1.05–1.33) and 45% (OR: 1.45; 95% CI: 1.29–1.63) higher for women residing in second-poorest and the poorest quintiles, respectively (Model 3). When we examine racial segregation and income inequality simultaneously (Model 4), both measures are still significantly associated with the odds of STDDP acquisition, and patterns are consistent with previous models. However, the associations of structural inequality and absolute deprivation are attenuated. Specially, the association between structural inequality and the odds of STDDP acquisition are less salient.

Discussion and Conclusion

Residential segregation and income inequality are critical to understanding the racial health disparities in the United States (Kawachi & Subramanian, 2014; Williams, 1996; Williams & Collins, 2001). Although previous studies on STD acquisition have documented the roles of racial segregation and income inequality, most of these studies have used either an individual-centered approach or an ecological approach (Biello et al., 2012; Pugsley et al., 2013). In this study, we expand on the previous approach to include neighborhood characteristics, examining the roles of racial segregation and income inequality on STDDP acquisition using a multilevel approach. Specifically, we hypothesized that residential segregation and income inequality would be negatively associated with the acquisition of STDDP independently but that the association of income inequality would disappear when residential segregation and income inequality were investigated jointly.

The results of this study demonstrate the importance of accounting for neighborhood-level factors: they are significantly associated with mothers' STDDP acquisition above and beyond mothers' individual characteristics. In addition, the results correspond with the place stratification hypothesis, the absolute deprivation hypothesis, and the structural inequality hypothesis. Consistent with the places stratification hypothesis, which posits that negative neighborhood conditions generated by individual and institutional discrimination against minority groups (Massey & Denton, 1993) can negatively affect individuals' health (Subramanian et al., 2005; Walton, 2009; Yang et al., 2014), residing in segregated neighborhood is associated with higher odds of STDDP acquisition through the direct pathway. However, the significant cross-level interaction terms indicate that black mothers residing in more segregated neighborhoods have the lower odds of STDDP acquisition compared with white mothers living in the same neighborhoods, indicating that residential segregation protected black mothers from the acquisition of STDDP. This pattern is consistent with previous research finding that residing in segregated neighborhood is associated with lower probability of maternal smoking during pregnancy for black mothers than for white mothers (Yang et al., 2014).

Although past research has identified the dimension of concentration as a determinant of racial health disparities (Acevedo-Garcia, 2000), we did not find evidence to support this claim. We offer three plausible explanations for this finding. First, we did not find black-white differences in concentration (see Table 1), which indicates that all mothers shared a similar influence of concentration, making this factor trivial. Second, some concepts related to segregation, such as social capital, cannot be measured at the tract level. Omitting these variables may dampen the association between concentration and the acquisition of STDDP. Finally, given that segregation comprises five dimensions (Massey and Denton, 1995), including only two dimensions in the analysis may not fully unveil the relationship of each segregation dimension with our dependent variable. Future efforts to explore these issues are warranted.

For income inequality, we found that mothers who reside in neighborhoods with a high level of structural inequality (relative measure of income distribution) and a high level of absolute deprivation (absolute measure of income distribution) have higher odds of STDDP acquisition compared with mothers residing in more-equal and less-deprived neighborhoods. These results echo those of previous research, which found that school-level structural inequality and absolute deprivation are associated with higher level of STD acquisition for adolescents (Harling et al., 2014). In the final model, which accounted for residential segregation and income inequality jointly, we found that although the association of residential segregation remained salient, the associations of income inequality were attenuated. This finding is also consistent with previous ecological research finding that the effect of residential segregation on community-level gonorrhea rates was stronger than the effect of income inequality (Pugsley et al., 2013).

Although investigating the specific mechanisms by which neighborhood-level residential segregation and income inequality are associated with STDDP acquisition is beyond the scope of this study, there are several possible explanations. First, highly segregated neighborhoods and socioeconomically disadvantaged neighborhoods may lack the health infrastructure and resources necessary to promote healthy and safe sexual behaviors. For example, lack of appropriate sexual health education in neighborhoods may be associated with more-risky sexual behaviors, such as ineffective condom usage and ignorance of STD symptoms. Indeed, previous studies have found that neighborhood disadvantage (i.e., measured by the absolute deprivation index) limits the availability of HIV/STD prevention information (Nation, 2008), and neighborhood disadvantage is also associated with less baseline condom use (Bauermeister et al., 2011).

Second, highly segregated neighborhoods and socioeconomically disadvantaged neighborhoods may have higher levels of neighborhood social disorganization—that is, the inability of a community to realize the common value of residents and maintain social control (Sampson & Groves, 1989), which can in turn influence individuals' risky sexual behaviors. For example, researchers have found that neighborhood disadvantage is associated with earlier sexual onset (Brewster, 1994) and more-risky sexual activities (Bauermeister et al., 2011). Future studies should investigate these specific mechanisms by which neighborhood-level segregation and income inequality may influence STDDP acquisition and the mechanisms by which racial disparity is generated. Elucidating the specific mechanisms will be crucial to designing more effective policy aimed at reducing the racial gap in STDDP acquisition.

This study has four limitations. First, because the data used in this study are cross-sectional, we cannot establish a causal relationship. To rule out the possibility of selection, future research should use longitudinal data to establish the causal relationship between neighborhood-level characteristics and the racial disparity in STDDP acquisition. Second, several individual-level measures that may be associated with the racial disparity in STDDP were not included because of data constraints (e.g., household income). Future research should investigate the role of relative disadvantage within neighborhoods on the acquisition of STDDP if individual-level income data are available (Harling et al., 2014). Third, our study focuses on black and white mothers in Pennsylvania, and it remains unclear whether our findings will be generalizable to other areas in the United States. It is plausible that residential segregation and income inequality may be associated different in other places with different racial histories (e.g., South). Therefore, future studies should try to replicate our findings in other contexts. Finally, the influence of neighborhoods may vary depending on how *neighborhood* is operationalized. Although using a census tract to define a neighborhood is a common practice in health research (Wight et al., 2013), future studies should be cautious of the modifiable areal unit problem (MAUP) (Openshaw, 1983), which refers to the possibility of producing different results when different scales or zones are used (Fotheringham et al., 2000; Wong & Fotheringham, 1991).

Despite these limitations, this study contributes to the literature on the racial disparity in STDDP acquisition by being the first to examine the roles of residential segregation and income inequality on STDDP acquisition within a multilevel framework. Our results demonstrate the importance of accounting for neighborhood-level factors, which we found to be significantly associated with STDDP acquisition above and beyond mothers' individual characteristics. This finding suggests that health policy makers aiming to prevent and reduce the prevalence of STDDP and reduce the racial disparity in STDDP should explicitly and carefully incorporate the notion of place in their policy design. Specifically, targeting neighborhoods with a high level of residential segregation may be beneficial in reaching more women at risk. In addition, targeting the most socioeconomically disadvantaged may yield most effectiveness in terms of reaching women at risk. This study is also the first to focus on STDDP as an outcome. Because STDDP acquisition can have serious lasting and cumulative implications for women and their children, trying to reduce the racial disparity in STDDP acquisition may offer dual protections for both women and their children. In sum, eliminating racial health disparities in the United States is an important public health concern reflected by *Healthy People 2020* (U.S. Department of Health and Human Services, 2011). To reduce the racial disparity in STDDP, future research should take a more-nuanced approach by examining risk factors at multiple levels.

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Table 1. Descriptive statistics of variables at both the individual level and the contextual level

	All	Non-Hispanic White	Non-Hispanic Black
Individual-level measures (N = 96,940)	100%	81.8%	18.2%
Acquisition of STDDP	5.5%	4.1%	12.1%
Maternal age			
Age	28.4	28.9	26.0
Age squared	838.8	866.8	713.1
Marital status			
Married	59.0%	67.6%	20.6%
Maternal education			
Less than high school	10.4%	8.6%	18.9%
High school diploma/GED	24.7%	22.2%	36.1%
Some college	28.5%	27.4%	33.0%
Bachelor's degree or higher	36.4%	41.8%	12.0%
Prenatal visit			
Total number of visits	10.9	11.2	9.4
Poverty status			
WIC Food	35.6%	28.3%	68.3%
Payment for delivery			
Private insurance	64.1%	71.3%	32.5%
Medicaid	31.0%	24.1%	61.5%
Self-pay	2.6%	2.7%	2.1%
Other	2.3%	1.9%	3.9%
Tract-level measures (N = 3,154)			
Residential segregation			
NHB:NHW isolation index	0.18	0.08	0.63
NHB:NHW concentration index	0.03	0.04	0.03
Income inequality (Gini index)			
Most-equal quintile	20.0%	22.8%	7.4%
2nd-most equal quintile	20.0%	22.2%	10.1%
Middle quintile	20.0%	21.2%	15.7%
2nd-least equal quintile	20.0%	18.6%	25.1%
Least-equal quintile	20.0%	15.1%	41.7%
Poverty index			
Richest quintile	20.0%	23.6%	4.0%
2nd-richest quintile	20.0%	23.4%	4.8%
Middle quintile	20.0%	23.0%	6.6%
2nd-poorest quintile	20.0%	20.1%	19.7%
Poorest quintile	20.0%	9.9%	64.9%

Note: Based on 25 imputed datasets.

Table 2. Multilevel logistic regression models predicting the acquisition of STDDP

	Model 1		Model 2		Model 3		Model 4	
Individual-level measures (N = 96,940)								
Race/Ethnicity (ref: Non-Hispanic white)								
Non-Hispanic black	1.64	***	1.68	***	1.55	***	1.60	***
Maternal age								
Age	0.92	***	0.92	***	0.92	***	0.92	***
Age squared	1.00	***	1.00	***	1.00	***	1.00	***
Marital status								
Married	0.48	***	0.47	***	0.48	***	0.49	***
Maternal education (ref: Less than high school)								
High school diploma/GED	0.92	+	0.91	*	0.92	+	0.92	+
Some college	0.81	***	0.80	***	0.82	***	0.82	***
Bachelor's degree or higher	0.61	***	0.60	***	0.63	***	0.62	***
Prenatal visit								
Total number of visit	1.00		0.99		0.99		1.00	
Poverty status								
WIC benefits	1.13	***	1.14	***	1.12	**	1.12	**
Payment for delivery (ref: Private insurance)								
Medicaid	1.47	***	1.46	***	1.44	***	1.44	***
Self-pay	0.71	**	0.70	**	0.70	**	0.70	**
Other	1.04		1.05		1.02		1.03	
Tract-level measures (N = 3,154)								
Residential segregation (direct associations)								
NHB:NHW isolation index	2.47	***					2.03	***
NHB:NHW concentration index	1.13						1.14	
Residential segregation (moderating associations)								
Black × NHB:NHW isolation index	0.56	***					0.59	***
Black × NHB:NHW concentration index	0.98						1.00	
Income inequality (Gini index)								
Most-equal quintile (reference)			1.00				1.00	
2nd-most equal quintile			1.02				1.01	
Middle quintile			1.13	*			1.08	
2nd-least equal quintile			1.09				1.00	
Least-equal quintile			1.26	***			1.10	+
Poverty index								
Richest quintile (reference)					1.00		1.00	
2nd=richest quintile					1.08		1.08	
Middle quintile					1.05		1.03	
2nd-poorest quintile					1.18	**	1.11	+
Poorest quintile					1.45	***	1.21	**
Variance Components								
Intercept	0.19	***	0.18	***	0.18	***	0.18	***

Note: Results are reported in odds ratios.
+p ≤ 0.10; *p ≤ 0.05; **p ≤ 0.01; ***p ≤ 0.001